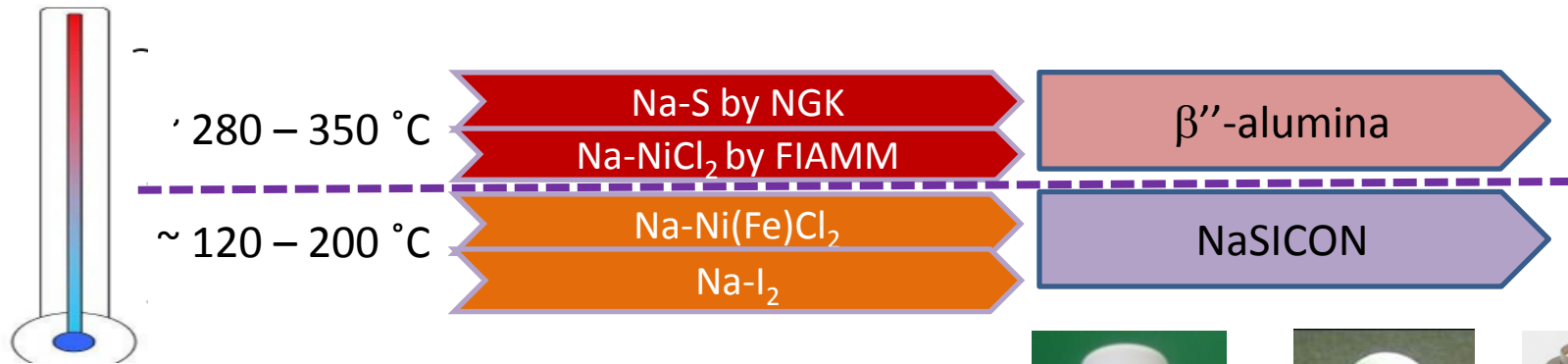


Objective: Demonstrate low-cost sodium batteries operating at lower temperature ($< 200\text{ }^{\circ}\text{C}$) than state of the art sodium batteries (Na-S, ZEBRA) based on highly conductive NaSICON ceramic membranes.



Technical Accomplishments

- Low-cost tubular NaSICON for long-term operation at $< 200\text{ }^{\circ}\text{C}$ w Na metal
- Novel plastic/ceramic/metal sealing methods appropriate for NaSICON & $< 200\text{ }^{\circ}\text{C}$ operation



250 Wh size Closed-end NaSICON Tube sub-assemblies

Technical Accomplishments

- Distinct cathode formulations (NiCl_2 & I_2) based on unique aqueous, organic, and molten salt catholytes.
- 100 Wh and 250 Wh cells showed desirable performance during 1+ year of operation.
 - Minimal degradation for long cycles
 - 80+% Energy efficiency
 - Comparable performance at conventional operation condition of ZEBRA, Na-S
 - Low cost from low RMC, O&M and CAPEX



100 Wh
Na-I₂



250 Wh
Na-NiCl₂

Path Forward

- NaSICON production development
- Unit cell optimization for multi-year operation
- Design & construction of multi kWh module
- Application specific techno-economic analysis



Future kWh
Module